THE NET PORTAL ABSORPTION OF METABOLITES AND THE OXYGEN CONSUMPTION OF THE PORTAL-DRAINED VISCERA IN MERINO SHEEP

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Portal blood analysis combined with the measurement of portal blood flow (PBF) is a useful tool for the measurement of nutrient absorption (Bergman 1975). Studies of this type have focused either on the effect of physiological state or on the level of feeding on the net portal absorption (NPA) of nutrients. The present study was undertaken to determine the response of NPA of several metabolites to feed intakes ranging from 70 to 130 % of maintenance requirements.

Catheters were inserted in the portal vein and femoral artery of 8 Merino wethers. An ultrasonic blood flow probe (Transonics Inc., Ithaca, NY) was placed around the portal vein for the measurement of PBF. A diet of lucerne chaff was fed continuously at four levels of intake calculated to meet 70, 90, 110, and 130 % of maintenance requirements in an experimental design of two 4 x 4 Latin Squares. Blood was sampled at hourly intervals for 8 hours from the portal and arterial catheters. PBF was also recorded. The NPA of metabolites was calculated by multiplying PBF by the portal-arterial concentration difference. Oxygen consumption of the portal-drained viscera (OC of the PDV) was the product of PBF multiplied by the arterial-portal concentration difference. The results for PBF, OC of the PDV, NPA of glucose, 3-hydroxybutyrate (3OHB), lactate, urea nitrogen (urea N) and α-amino nitrogen (AAN) are presented below.

Parameter		Feed intake (% of maintenance requirements)			
		70	90	110	130
PBF	(L/hr)	56.40±1.80[a]	57.60±1.80	61.80±1.80	69.60±1.80
OC of the PDV	(mmol/hr)	91.20±13.0	138.10±13.30	172.0±11.90	178.30±12.90
NPA of Glucose	(mmol/hr)	-3.54±0.90	-6.18±1.74	-4.50±0.96	-3.18±0.88
NPA of 3OHB	(mmol/hr)	11.11±1.12	14.38±1.15	13.67±1.03	18.12±1.12
NPA of Lactate	(mmol/hr)	2.52±0.84	3.66±0.90	3.30±0.78	4.32±0.84
NPA of Urea	(mmol N/hr)	0.06±1.32	-2.34±1.32	-2.04±1.20	-2.88±1.26
NPA of AAN	(mmol N/hr)	9.96±3.12	12.06±3.18	14.64±2.88	16.68±3.12

[a] Least squares mean ± S.E.

PBF and OC of the PDV increased significantly ($P<0.05$) as feed intake increased. The increase in OC of the PDV reflects the increased costs of digestive and absorptive processes associated with digestion. The NPA of glucose did not alter significantly. Negative values indicating a net utilization of glucose by the gut tissue are often observed, as glucose is not a major product of digestion in ruminants, and is taken up from arterial blood to meet the glucose requirements of the gut (Bergman et al. 1970). The increase in NPA of 3OHB probably reflects increased butyrate production in the rumen as a large proportion of butyrate is converted to 3OHB in the rumen epithelium (Reynolds and Huntington 1988). The NPA of AAN, urea N and lactate all rose in response to increased feed intake, but in all cases the changes were not statistically significant.

BERGMAN, E.N. (1975). In 'Digestion and Metabolism in the Ruminant', p. 292, eds I.W. McDonald and A.C.I. Warner.(UNE: Armidale).

BERGMAN, E.N., KATZ, M.L., and KAUFMAN, C.F. (1970). J. Physiol. 219:785.

REYNOLDS, C.K., and HUNTINGTON, G.B. (1988). Br. J. Nutr. 60:553.

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